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**QUESTIONS AND ANSWERS CONCERNING TOBACCO
CONSTITUENTS AND INGREDIENTS**

1. What are tobacco "constituents" and how are they derived?

ANSWER: Tobacco is an agricultural product. Like all agricultural products, it contains trace elements of dozens of chemical constituents. None of these individual constituents is unique to tobacco smoke. They can be found in many foods and plant-derived products such as tomatoes, beer, cosmetics and bacon. Some elements occur naturally in the tobacco plant itself or are derived from the soil in which the plant is grown. Others are derived from curing and fermentation. Such processes trigger a series of organic changes that are responsible for creating the distinctive flavor and enjoyable taste consumers experience in consuming tobacco products, just as they impart a distinctive taste and flavor to wine, beer, cheese and the like.

The burning of tobacco, like the burning of other natural products such as wood or charcoal, or the grilling of a steak, produces chemical compounds as by-products of the combustion process. A small amount of carbon monoxide, for example, is a by-product of a burning cigarette just as it is a by-product of a gas stove, heater, campfire or even our own normal respiration.

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2. Are these constituents dangerous?

ANSWER: Almost any substance, including those that are necessary to sustain life itself, such as Vitamins A and D, or even the water we drink and the air we breathe, can be toxic if a person is exposed to high enough concentrations. The technology exists to detect minute concentrations of many substances in tobacco and tobacco smoke. No scientific study has established, however, that these minute traces are harmful in the quantities measured.

It should be noted, in addition, that some compounds that are carcinogenic in test animals, when applied in isolation, have been found to be anti-carcinogenic when applied in combination with each other. It has long been known that certain smoke constituents act as anti-carcinogens in test animals. For example, tobacco belongs to the selenium-accumulating group of plants, and selenium at low levels has been shown to possess anti-carcinogenic properties. Also, many constituents of cigarette smoke have been found to be anti-carcinogenic when applied with true carcinogens in test animals. Even scientists who believe, based on epidemiological studies, that whole tobacco smoke is carcinogenic have been unable to prove or even agree on which constituent or constituents in tobacco smoke might act as a carcinogen in humans. From a scientific standpoint, therefore, it is not meaningful to focus upon the effect of any one constituent or combination of

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constituents in isolation from the others, especially at the very low levels encountered in tobacco smoke, or based on animal tests of unknown relevance to man.

3. Why don't the companies publicly disclose the constituents of tobacco smoke?

ANSWER: There is nothing secret about the constituents of tobacco smoke. Many laboratory studies have collected smoke from burning cigarettes and tested the smoke for the presence and amount of various compounds. Findings from these studies can be located in any scientific library in articles and governmental reports on the chemical composition of tobacco smoke. The most well-known compounds are tobacco smoke condensate ("tar") and nicotine. Information about the "tar" and nicotine levels of the leading cigarette brands has been widely publicized. With respect to the other constituents of tobacco smoke, a representative of the Oak Ridge National Laboratory (ORNL) testified before a Subcommittee of the United States Congress in 1988, that, based on research conducted by ORNL, testing for other constituents would not affect the relative ranking of cigarettes as determined by "tar" and nicotine or provide information that would affect a smoker's choice among the different brands of cigarettes that are available.^{1/}

^{1/} Cigarettes -- Advertising, Testing, and Liability:
Hearings on H.R. 4543 before the Subcomm. on Transportation,
(footnote cont'd)

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4. Why don't the companies provide additional information and warnings about constituents on the cigarette package labels?

ANSWER: The inclusion on cigarette packages of detailed information on smoke constituents is unlikely to benefit consumers and may even be counterproductive, particularly in those countries that require the inclusion on cigarette packages of smoking and health warnings. Warning labels have proliferated on numerous consumer products during the past several decades, particularly in the United States. This has led a number of communications experts to voice a concern about "warning overload" -- that is, a tendency on the part of consumers to begin to ignore warning labels entirely.^{2/} Other research has shown that, if presented with too much label information, many consumers will misunderstand the warnings. In fact, one study found that consumers thought products with rather elaborate warning labels were safer than those without them. The study concluded

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Tourism, and Hazardous Materials of the House Comm. on Energy and Commerce, 100th Cong., 2d Sess. 204 (1988) (statement of Michael D. Guerin). Dr. Guerin testified that the potential additional constituents of tobacco smoke are not, per se, harmful compounds. Id. at 211.

^{2/} See generally Schwartz, V.E. and Driver, R.W., "Warnings in the Workplace: The Need for a Synthesis of Law and Communications Theory." 52 Cinn. L. Rev. 38 (1983); Twerski, A.D., et al., "The Use and Abuse of Warnings in Products Liability: Design Defect Litigation Comes of Age, 61 Corn. L. Rev. 495 (1986)(warning labels lose effectiveness if they "cry wolf" too many times).

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that consumers were viewing the warning "as an indication the manufacturer [was] very careful."^{3/} Another found that symbols such as the skull and crossbones made the containers on which they were placed more attractive to young children.^{4/}

5. Are tobacco smoke constituents poisonous?

ANSWER: Many substances that are poisonous at exceptionally high exposures -- such as carbon monoxide, nitric oxide (NO), formaldehyde, selenium, nickel, cobalt, arsenic -- also are essential nutrients or normal metabolic by-products at the usual levels encountered. Nitric oxide, for example, is the physiological substance that helps regulate blood pressure. The compounds present in smoke, therefore, are not exclusive to smoke but ubiquitous; they are present in many consumer products and in most environments. Ambient exposure to the constituents of tobacco smoke is generally at levels that are far below those officially permitted for continuous exposure in occupational situations. Individual constituents are discussed in greater detail below.

^{3/} "Do Warning Labels Work?", Newsweek, p. 40-41 (July 18, 1988) (quoting Michael Ursic).

^{4/} Schneider, K.C., "Prevention of Accidental Poisoning Through Package and Label Design," Journal of Consumer Research 67-74 (September, 1977).

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A. Nicotine.

Nicotine is naturally found in and ingested from many common foods, such as potatoes, tomatoes, eggplant and peppers. At the levels encountered by smokers, it is a mild stimulant not unlike caffeine. Nicotine is officially permitted and advertised as an aid to quit smoking, at doses similar to or higher than those experienced by smokers. The theories that nicotine affects atherosclerosis by interfering with fatty acid metabolism, or that it potentiates the action of carcinogens, remains a wholly unsubstantiated hypothesis.

B. Carbon Monoxide.

Carbon monoxide is a by-product of normal respiration. It is produced by humans naturally and safely regardless of external exposure. There is no persuasive evidence that CO, at the levels found in cigarette smoke, is harmful.

C. Nitrogen Oxides.

The possible toxic effects of nitrogen oxides at the levels experienced by smokers remain hypothetical. In addition, nitric oxide is produced by the human body naturally in order to help regulate blood pressure.

D. Hydrogen Cyanide

This compound is found naturally in many foods such as almonds, apricot seeds, peach, pear, apple and plum

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pits. Although hydrogen cyanide is toxic at high levels, its toxicity at smoker exposure levels remains hypothetical.

E. Polonium 210 and Potassium-40.

Polonium 210 and potassium-40 are found in all edible vegetables. A serving of spinach is quite radioactive under the proper detector. The toxicity of these substances in tobacco smoke remains speculative despite considerable study.

F. Formaldehyde.

Formaldehyde is present in all human and animal tissues as a natural consequence of life processes. It is also present in varying quantities in common foods. It can be toxic at high levels, but only much above those experienced by smokers.

G. Arsenic and Metals.

Arsenic, nickel and cobalt are essential nutrient metals at low doses, although they are toxic at doses much greater than those experienced by smokers. Virtually all metals can be found in common vegetables and foods.

Arsenic, along with DDT, was once in common use as a pesticide. Today, they are rarely used and are banned in most countries. Numerous studies have shown that residues of inorganic insecticides in tobacco have decreased sharply in recent years, and the levels of

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arsenic in tobacco are of no significance at the present time.

H. Other Constituents.

The following substances are by-products of the combustion process. They are not toxic at the levels present in tobacco smoke:

Acetone
Acetonitrile
Acrolein
Ammonia
Aniline
Benzene
Hydrazine
Methanol
Napthalene
Pyrene
Toluene
Toluidine
Urethane

By contrast, the following substances are naturally occurring constituents of the tobacco plant. Like those listed above, they are not toxic at the levels found in tobacco smoke:

Butane
Catechol
Phenol
Pyridine

Finally, the following substances are either taken up by the tobacco plants from the soil or deposited on them from the air. They also are not toxic at the levels found in tobacco smoke:

Cadmium
Nickel
Polonium 210

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6. What effect do tobacco smoke constituents have on non-smokers exposed to cigarette smoke?

ANSWER: The environmental tobacco smoke (ETS) to which the non-smoker is exposed is composed of sidestream and exhaled mainstream smoke that "ages" chemically and is very substantially diluted by the surrounding air. As a consequence of this aging and dilution, non-smokers -- even in the "smokiest" environments such as a crowded pub or bar -- are exposed at most to trace amounts of chemicals that can be attributed to tobacco smoking. Indeed, a series of studies has shown that a non-smoker would have to spend several hundred hours in the "smokiest" bar and even longer in the typical office or restaurant environment to be exposed to the nicotine equivalent of a single cigarette.^{5/} Tobacco smoke in the air may be annoying or bothersome to some people, but it is not a demonstrated health hazard for non-smokers. In November 1989, some 80 scientists from 20 countries attended a symposium on ETS at McGill University in Montreal, Canada. Following a comprehensive review of the relevant data, the participants concluded that ETS

^{5/} See e.g., Hinds, W. and M. First, "Concentrations of Nicotine and Tobacco Smoke in Public Places," New Engl. J. Med. 292 (16): 844-845, 1975; Press Release, "Study of Air Quality in 100 N.Y.C. Restaurants, Offices Shows Tobacco Smoke in Insignificant Factors," The (U.S.) Tobacco Institute, Dec. 10, 1986).

has not been shown to present a health hazard to non-smokers.^{6/}

7. Are the constituents of tobacco smoke unique to the product?

ANSWER: No. Many constituents are prevalent in the indoor air of homes as well as business establishments, including restaurants, hotels, office buildings, theaters, supermarkets, medical facilities and retail stores. Several constituents are present in drinking water as well as most foods. Attachment A lists alternative sources of fourteen individual substances also found in minute quantities in tobacco smoke.

It should also be noted that the average indoor environment contains a myriad of complex chemical compounds. Some are found at trace levels in tobacco smoke, but most others are not. Attachment B summarizes the expected incidence of seventeen listed chemicals that have been identified as carcinogens or reproductive toxicants in the indoor air of various business establishments and the various sources of those chemicals.

8. Are there pesticide residues in cigarettes?

ANSWER: Tobacco is an agricultural commodity. Like any other crop grown by farmers, including virtually all food

6/ D. Ecobichon & J. Wu., (eds.) Environmental Tobacco Smoke, Proceedings of the International Symposium at McGill University (1990).

products, tobacco is treated with pesticides to prevent destruction by insects and other pests. Some pesticides, whether used on a tobacco crop or a food crop, will leave a small amount of residue.

9. Are pesticide residues dangerous?

ANSWER: The pesticides used on tobacco are carefully regulated throughout the world. Not surprisingly, then, there is no credible evidence to suggest that pesticide residues as found in cigarettes present a health concern. Not even the United States Surgeon General has claimed that the minute amounts of pesticide residues in cigarettes are a health problem. In cigarettes, not only are pesticide residues present only in minute quantities, but as a cigarette is smoked, a high percentage of the residue is destroyed or deposited in the ash. As a result, only a small portion of the already minuscule amount of residue in a cigarette reaches tobacco smoke.

Smoking and health research confirms that the trace levels of pesticide residues in smoke are not toxicologically significant. Indeed, the levels of pesticides found in tobacco smoke are below the tolerance levels generally prescribed for foods. These residues have been tested as an integral part of every chronic animal experiment analyzing the effect of whole smoke or cigarette smoke condensate. From these studies, the pesticide residues found on tobacco have not been shown to present a risk to human health.

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10. What are the companies doing to protect consumers from pesticide residues?

ANSWER: The cigarette companies seek to purchase high quality leaf free of excessive pesticide residues. The companies monitor pesticide residues by participating in various independent testing programs and by conducting in-house testing. In the United States, for example, the leading tobacco companies since 1970 have funded a program to test for pesticide residues at North Carolina State University. This program monitors residues in cigarettes and in flue-cured, burley, cigar and pipe tobacco.

11. What is the difference between an "ingredient" and a "constituent?"

ANSWER: These terms are often confused. "Constituent" refers to the chemical compounds produced in or from the tobacco plant itself during the growth or curing process or the burning of a cigarette. "Ingredients" are substances added during the manufacturing process in order to process or flavor the tobacco.

12. Why are ingredients used?

ANSWER: Some ingredients aid in processing tobacco in the initial stages of cigarette manufacture. Ingredients that help in the processing of tobacco remain in the final cigarette in minute quantities, if at all. Other ingredients are used as casing materials or humectants. Casing materials, such as sugar, help to smooth and balance the taste of cigarettes, while humectants keep

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the tobacco in cigarettes moist. Finally, many of the ingredients are used to give individual brands of cigarettes their distinctive flavor and aroma.

13. Why are so many ingredients used?

ANSWER: To put the number of ingredients in perspective, it is worthwhile to note that there are several thousand different brands and packings of cigarettes sold worldwide. About twenty ingredients comprise approximately 99% of the total amount, by weight, of ingredients used in the industry. The other ingredients are used in smaller amounts, and most are used in extremely small quantities as part of flavor formulations. These formulations often include a number of ingredients, but typical industry-wide usage of individual flavor components is under 10 pounds a year. This is in contrast to the over 850 million pounds of tobacco employed in cigarettes sold in the United States each year. The flavor formulations used by the companies change occasionally as new products are introduced or existing products are reformulated in response to consumer preferences.

14. Are the ingredients used in American cigarettes different from those used in English or other cigarettes?

ANSWER: American-style cigarettes are a blend of different types of tobacco, some of which call for more ingredients than others. Consequently, where American-

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style blended cigarettes are the norm, there may be only slight differences in the numbers of ingredients used by manufacturers in different countries.

However, there are certain countries, such as the U.K. and its former colonies, where smokers prefer cigarettes that do not contain a blend of different types of tobacco but contain only Virginia-style flue-cured tobacco. The latter do not require as many ingredients to smooth their taste as do some of the tobaccos found in blended cigarettes. Nevertheless, ingredients are used in Virginia-style cigarettes as well.

15. Haven't the cigarette manufacturers started using more and more ingredients to compensate for the reduction of tar and nicotine in cigarettes?

ANSWER: Neither the number nor quantity of casing materials (which smooth and balance the taste of cigarettes) or moisturizing agents have changed as a result of the growing range of tobacco products, including the introduction of lower "tar" and nicotine brands. While the number of flavors that constitute the special aromas of individual brands may have increased, it is important to note that flavors are used in minuscule amounts, the total of all flavors used constituting less than one tenth of one percent by weight of a finished cigarette.

16. Why hasn't the identity of ingredients been provided to the public?

ANSWER: Because they contribute to the taste and appeal of individual brands, the identities of specific

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ingredients in cigarettes are also closely guarded trade secrets. Disclosure of the ingredients used in cigarette manufacture could reveal product formulas that required years of research to develop.

17. Are the ingredients used in cigarettes harmful?

ANSWER: No. Ingredients used in cigarettes have certainly not been shown to be harmful at the levels at which individual ingredients are used.

18. What evidence is there that the ingredients are not harmful?

ANSWER: Most ingredients used in cigarettes manufactured in the United States are commonly used in foods, have been reviewed by the Food and Drug Administration (FDA) and are included on the FDA lists of approved food additives or substances "generally recognized as safe" (GRAS), or on the Flavor Extract Manufacturers Association's GRAS list. Furthermore, governmental bodies in a number of countries, such as Great Britain and West Germany, have evaluated the ingredients used in cigarettes in those countries.

Virtually all of the ingredients used by the leading United States cigarette manufacturers can be found on the accepted lists of one or more of the following governmentally affiliated or recognized organizations: the U.S. Food and Drug Administration, FEMA-GRAS, the U.S. Independent Scientific Committee on Smoking and Health (Hunter-Froggatt Committee), and the

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relevant government departments and agencies of Canada, Belgium, Switzerland, France and the Council of Europe.

19. Are there any substances that historically have been used as ingredients in cigarettes that are now regarded as hazardous?

ANSWER: Cigarette manufacturers continuously review the questions that have arisen concerning ingredients. The companies believe that there is no harm to smokers from the addition to cigarettes of former or current ingredients. Indeed, most of the major ingredients used in the production of cigarettes are either foods or are approved for use in foods or in the manufacture of food products.

20. Have each of the ingredients been tested to ensure that they are not harmful?

ANSWER: Since most of the ingredients are approved for use in foods, testing to determine their toxicity has been conducted. Furthermore, the scientific literature on all ingredients also has been reviewed. This is always the first step in determining acceptability. In addition, patterns of usage of ingredients in consumer products have been studied. The literature and data from all the tests as well as the scientific literature demonstrate that the ingredients used are not harmful. Furthermore, the tobacco companies have conducted their own additional tests.

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21. What effect do ingredients have on non-smokers exposed to cigarette smoke?

ANSWER: Cigarette manufacturers continuously review questions that have arisen concerning ingredients. The companies believe that the addition to cigarettes of the ingredients on the list is not harmful to smokers. The companies likewise believe that the addition of ingredients to cigarettes is not harmful to non-smokers who may be exposed to cigarette smoke.

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**SELECTED CHEMICALS IDENTIFIED AS CARCINOGENS OR REPRODUCTIVE TOXICANTS
EXPECTED TO BE PRESENT IN INDOOR AIR**

Listed Chemicals	Restaurants and Bars	Theaters	Hotels and Motels	Office Bldgs.	Schools	Hospitals	Possible Source*
Acetaldehyde	X	X	X	X	X	X	a,f
Arsenic and Inorganic Arsenic Compounds	X	X	X	X	X	X	f
Asbestos	X	X	X	X	X	x	h
Benzene	X	X	X	X	X	X	a,j
Benzo(a)pyrene	X	X	X	X	X	X	a,f,k
Chloroform	X	X	X	X	X	X	d
Chromium and Certain Chromium Compounds	X	X	X	X	X	X	f
1,2-Dichloroethane	X	X	X	X	X	X	d,e,j
Di(2-Ethylhexyl)- Phthalate	X	X	X	X	X	X	i
Formaldehyde	X	X	X	X	X	X	b,c
Hexachlorocyclohexane	X	X	X	X	X	X	g
Lead**	X	X	X	X	X	X	a
Methylene Chloride	X	X	X	X	X	X	d,e,j
Perchloroethylene	X	X	X	X	X	X	d,e,j
Soots, tars, and oils	X	X	X	X	X	X	f,j
Trichloroethylene			X			X	d,e,j
2,4,6-Trichlorophenol	X	X	X	X	X	X	l

Key to Possible Sources: (a) Ambient air-adjacent sources, e.g., automotive and diesel exhausts from parking lots and garages; (b) building materials (particle board, plywood, area formaldehyde resin products); (c) carpeting, decorations, draperies, furniture, upholstery; (d) cleaning compounds; (e) consumer aerosol products and residues (carpet cleaners, sprays, furniture polishes and waxes; room freshener; rust removers, etc.); (f) fossil fuel, wood and charcoal combustion; (g) fumigation and insect sprays; (h) insulation material; (i) leaching from flexible polyvinyl chloride products (tubing, piping, wrap, calendered film, sheeting and coated fabric; (j) paints, solvents, paint thinners and removers, furniture strippers; (k) roasting, grilling, charbroiling; (l) wood preservatives.

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